

The Scottish Mathematical Council

www.scot-maths.co.uk

MATHEMATICAL CHALLENGE 2016–2017

Entries must be the unaided efforts of individual pupils.

Solutions must include explanations and answers without explanation will be given no credit.

Do not feel that you must hand in answers to all the questions.

CURRENT AND RECENT SPONSORS OF MATHEMATICAL CHALLENGE ARE

The Edinburgh Mathematical Society, The Maxwell Foundation, Professor L E Fraenkel,

The London Mathematical Society and The Scottish International Education Trust.

The Scottish Mathematical Council is indebted to the above for their generous support and gratefully acknowledges financial and other assistance from schools, universities and education authorities.

Particular thanks are due to the Universities of Aberdeen, Edinburgh, Glasgow, Heriot Watt, St Andrews, Stirling, Strathclyde and to Bearsden Academy, Kelvinside Academy and Northfield Academy.

Middle Division: Problems 1

- M1.** A victorious football team in an open-top bus is scheduled to leave the home ground and arrive at the town hall at 11 am. If the bus travels at 15 mph it will arrive 8 minutes early. However if it travels at 10 mph it will arrive 8 minutes late. At what speed must it travel to arrive at 11 am exactly?

- M2.** (a) Adam has a five-digit number

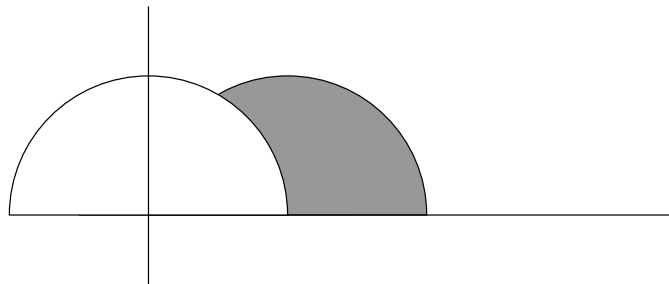
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When he places a 1 at the end of this number it becomes three times larger than when he placed a 1 at the start.

Find the five-digit number.

- (b) If you added a 1 in the same way to a 3-digit number how many times larger would it be?

- M3.**



The diagram shows parts of two circles, each with radius 1 unit, and centres on the x -axis at $x = 0$ and $x = 1$. Determine the **exact** value of the shaded area.

- M4.** A pyramid stands on horizontal ground. Its base is an equilateral triangle with sides of length a , the other three edges of the pyramid are of length b and its volume is V . Show that the volume of the pyramid is

$$V = \frac{1}{12}a^2\sqrt{3b^2 - a^2}.$$

SEE OVER FOR QUESTION M5.



Mathematical Challenge Problems 1

MIDDLE DIVISION 2016-2017

PLEASE USE CAPITALS TO COMPLETE

SURNAME

OTHER NAME(S)
(underline the one
you prefer)

SCHOOL

AGE

YEAR OF STUDY

FOR OFFICIAL USE

Marker

Marks

1	2	3	4	5

Total

— — — — - C U T A L O N G H E R E — — — —

Please write your solutions on A4 paper and staple the above form to them.

PLEASE WRITE YOUR NAME ON EVERY PAGE.

Send your entry through your school to the section organisers.

For further information on the competition, please see the Information Circular, which has been distributed to all secondary schools. Please contact the local organiser, whose name and address are given above, if you require a further copy.

M5. Eight islands each have one or more air services. An air service consists of flights to and from another island, and no two services link the same pair of islands. There are 17 air services in all between the islands.

Show that it must be possible to use these air services to fly between any pair of islands.

END OF PROBLEM SET 1

CLOSING DATE FOR RECEIPT OF SOLUTIONS :

27th September 2016

Look out for Problems 2 in early December!

Look on the SMC web site:

www.scot-maths.co.uk

for information about Mathematical Challenge